



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/604,905	08/26/2003	Jay S. Burnham	BUR920020109US1	1904
30449	7590	10/25/2005	EXAMINER	
SCHMEISER, OLSEN + WATTS			BLUM, DAVID S	
3 LEAR JET LANE			ART UNIT	
SUITE 201			PAPER NUMBER	
LATHAM, NY 12110			2813	

DATE MAILED: 10/25/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/604,905

Applicant(s)

BURNHAM ET AL.

Examiner

David S. Blum

Art Unit

2813

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 August 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-30 is/are pending in the application.
- 4a) Of the above claim(s) 16-30 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-15 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☒ Claim(s) 1-30 are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 26 August 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
- Paper No(s)/Mail Date 8/26/03; 10/24/05; 2/20/04

- 4) ☐ Interview Summary (PTO-413)
- Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

This action is in response to election filed 8/1/05.

DETAILED ACTION

Election/Restrictions

1. Applicant's election with traverse of claims 1-15 in Paper No. 8/1/05 is acknowledged. The traversal is on the ground(s) that the search for all claims is sufficiently related so that a search for both inventions would not create a serious burden. This is not found persuasive because until a search is performed, one cannot measure the size of the burden that would be created. In addition, the two claim sets are of a different invention, one a method and the other a device.

The requirement is still deemed proper and is therefore made FINAL.

2. Claims 16-30 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected invention, there being no allowable generic or linking claim. Applicant timely traversed the restriction (election) requirement in the paper filed 8/1/05.

Information Disclosure Statement

3. The information disclosure statement filed 2/20/05 fails to comply with 37 CFR 1.98(a)(2), which requires a legible copy of each cited foreign patent document; each non-patent literature publication or that portion which caused it to be listed; and all other

Art Unit: 2813

information or that portion which caused it to be listed. It has been placed in the application file, but the information referred to therein has not been considered.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1-2 and 5-11 are rejected under 35 U.S.C. 102(b) as being anticipated by Kobayashi (EP 0 886 308 A2).

Kobayashi teaches all of the positive steps of claims 1-2 and 5-11 as follows.

Regarding claim 1, Kobayashi teaches forming a silicon dioxide layer on a top surface of a substrate (column 2 line 55) performing a plasma nitridation in a reducing atmosphere to convert the silicon dioxide into a silicon oxynitride layer (column 3 lines 13-28, reaction gases listed include reducing atmosphere gasses).

Regarding claim 2, Kobayashi does not refer to the method as a remote plasma nitridation, but rather states there is a problem with direct nitridation (column 2 lines 8-

Art Unit: 2813

10, and describes a method as in the instant specification, thus the method taught by Kobayashi is remote nitridation even though not labeled as such).

Regarding claim 5, the plasma comprises nitrogen, an inert gas and a reducing gas (column 3 lines 15-28).

Regarding claim 7, the substrate is silicon (or others column 3 lines 5-13), and the silicon dioxide layer is formed by thermal oxidation (and other methods, column 3 lines 1-5).

Regarding claim 8, the silicon oxide layer is about 8-23 angstroms (column 2 lines 55-56, 1-20nm=10-100 angstrom).

Regarding claim 9, Kobayashi does not teach a resultant silicon oxynitride layer of about 8-24 angstroms, but does teach the goal of the invention to have a resultant gate insulating film of 3nm (30 angstroms) or less (column 1 lines 29-30), which is about 8-24 angstroms.

Regarding claim 10, the nitrogen content in the silicon oxynitride is between about 2-20 percent (11 %, column 9 line 34).

Art Unit: 2813

Regarding claim 11, the nitrogen content in the silicon oxynitride is between about $1\text{E}21$ and $1\text{E}22$ atm/cm³ (11 %, column 9 line 34). This is the same concentration as listed in claim 10, only another way of describing the concentration.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 12-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kobayashi (EP 0 886 308 A).

Kobayashi teaches all of the positive steps of claims 12-15 as recited above in regard to claim 1, except for the dose of nitrogen imparted to the silicon dioxide and resultant uniformity.

Kobayashi teaches the same method of claim 1, and results in the same nitrogen concentration (as in claim 10 above), therefore, it is obvious to one skilled in the requisite art that the same dosage would be imparted.

Regarding claim 13, Kobayashi is silent as to the growth of the silicon oxynitride as to the silicon oxide layer, but teaches the resultant oxynitride layer cannot be made greater

Art Unit: 2813

than a certain level (column 1 lines 56-57). Further, Kobayashi teaches the nitrogen to be incorporated into the silicon oxide film, but does not teach or suggest any thickness growth, only control of the resulting thickness. Thus without evidence to the contrary, Kobayashi suggests a growth of 0-35%.

Regarding claim 14, Kobayashi is silent as to the thickness of the resulting layer's mean thickness varying by no more than 0.5 angstrom sigma from a center to an edge of the substrate. However, Kobayashi teaches the method (which is identical to that of the instant claims) for improved control of the resultant film. Thus without evidence to the contrary, the method of Kobayashi will result in the mean thickness varying by no more than 0.5 angstrom sigma from a center to an edge of the substrate.

Regarding claim 15, Kobayashi is silent as to the nitrogen concentration not varying by more than 25% from a center to an edge of the substrate. However, Kobayashi teaches the method (which is identical to that of the instant claims) for improved control of the resultant film. Also, Kobayashi teaches a concentration gradient only with the depth of the thickness, suggesting a uniform concentration along the surface. Thus without evidence to the contrary, the method of Kobayashi will result in the mean thickness varying by no more than 0.5 angstrom sigma from a center to an edge of the substrate.

8. Claims 3- 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kobayashi (EP 0 886 308 A) in view of McFadden (US 6610615 B1).

Kobayashi teaches all of the positive steps of claims 3-4 as recited above in regard to claim 1, except for specific gasses and how the gasses are placed into the chamber.

Regarding claim 3, Kobayashi teaches an apparatus where the gasses are flowed into a single gas inlet in the chamber (figure 10). However, Kobayashi teaches that the gasses may react singly or in combination(column 10 lines 36-39) suggesting that there is no resultant product change dependent upon whether the gasses are placed into the chamber through a single inlet or multiple inlets. Without evidence to the contrary, this limitation is an apparatus limitation rather than one on the actual process of making a film.

Apparatus limitations, unless they affect the process in a manipulative sense, may have little weight in process claims. In re Tarczy-Hornoch 158 USPQ 141, 150 (CCPA 1968): In re Edwards 128 USPQ 387 (CCPA1961); Stalego v. Heymes 120 USPQ 473, 478 (CCPA 1959); Ex parte Hart 117 USPQ 193 (PO BdPatApp 1957); In re Freeman 44 USPQ 116 (CCPA 1940): In re Sweeney 72 USPQ 501 CCPA 1947).

Further, McFadden teaches a process of nitridation where the individual gasses are placed into the chamber rather than pre-mixed.

Regarding claim 4, Kobayashi teaches using a nitrogen gas and an inert gas. The inert gas of Kobayashi is argon, neon, or the like (column 3 lines 23-24). The term "or the

like' suggests other inert gasses may be used. McFadden teaches plasma nitridation of silicon oxide using an inert gas such as helium because the helium has a lower ionization energy (abstract).

It would be obvious to one skilled in the requisite art at the time of the invention to modify Kobayashi by using helium as the inert gas as taught by McFadden because helium has a lower ionization energy (abstract).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to David S. Blum whose telephone number is (571)-272-1687) and e-mail address is David.blum@USPTO.gov .

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead Jr., can be reached at (571)-272-1702. Our facsimile number all patent correspondence to be entered into an application is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Application/Control Number: 10/604,905

Page 9

Art Unit: 2813

A handwritten signature in black ink, appearing to read 'DSB', followed by a horizontal line extending to the right.

David S. Blum

October 24, 2005